



# Design For More-than-humans

## Biomimetic and Multi-species Interactions

David Sánchez, Tecnológico de Monterrey

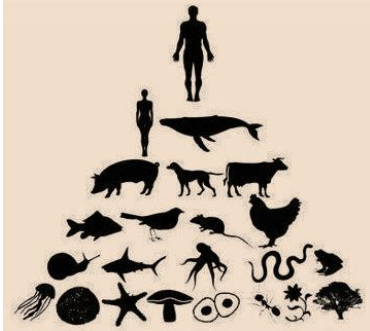
Jeongki Lim, Parsons School of Design, The New School & Aalto University

Thursday, August 17th 2023

Aalto Summer School 2023: Living with Woods

Photo: Ximena Curiel

# Dichotomy. Nature vs. Human



The root of our contemporary environmental crisis lies in our values as human specie because we assume things like:

- 1) A fundamental difference of wanting to separate humans from nature.
- 2) As humans we feel an inherent superiority over the non-human world.
- 3) As people we have the right to exercise control over the natural world, an ethic on the rights of natural elements is not restricted.

# Disconnection: Numbness and Distraction

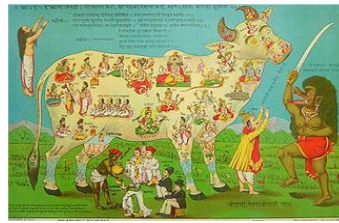


Our generation is the one is facing various crises:

- 1) Our senses are not well stimulated and seemed numb (food, spaces, materials..)
- 2) Perhaps we are oversaturated of information even the availability of wisdom
- 3) Design/Creation need to be constantly questioned and accepted collectively (Co-designed/Co-Created).



**Naturalistic**



**Moralistic**



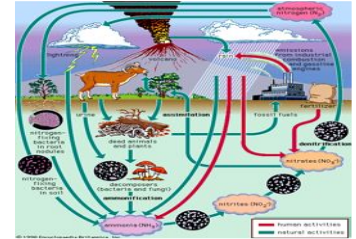
**Dominionistic**



**Aesthetic**



**Unconscious**



**Scientific**



**Utilitarian**



**Negativistic**



**Humanistic**



**Symbolic**

**9 recognized biophilic values**  
*(Stephen Kellert, 2012)*



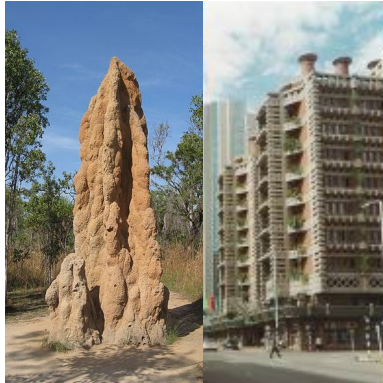
Kingfisher/ Shinkansen Train Japan. (Westra, 2011)



Fractal Coast (Douglas, 2007 cc)



Solar Tree(Ross Lovegroove 2011)



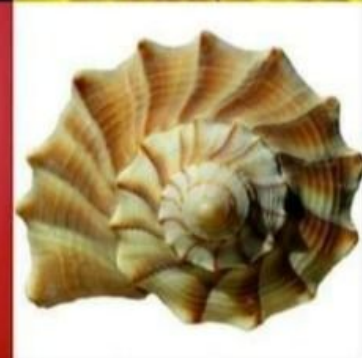
Termite mound/Eastgate Building Harare(Mick Pearce, 1996)



# Biomimicry-Bionics-Biodesign-Biomimetics

(Conscious emulation of nature's genius)

**What Nature  
is telling us?**



# Life's Principles

- Works with sunlight
- Use only the energy needed
- form follows function
- recycle everything
- reward for cooperation
- Protect diversity
- Demand local expertise
- Removes excess
- Touch the power of limits



Processes



Functions



Forms

Behaviours



System organisation



Materials



Algorithms



'In art we imitate nature:  
when we weave we imitate  
the spider, when we build,  
the swallow, when we sing,  
the swan and the  
nightingale'

*(De sollert., 20.974 A)*

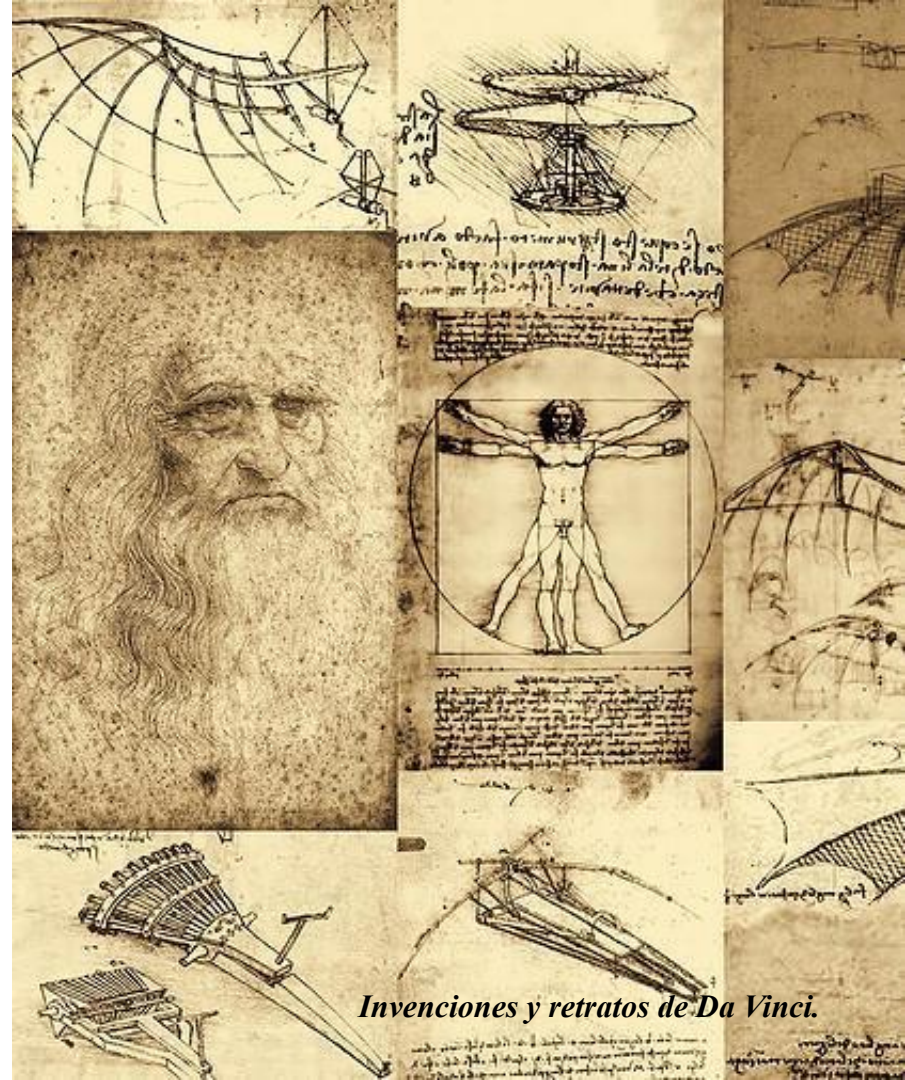


Democritus

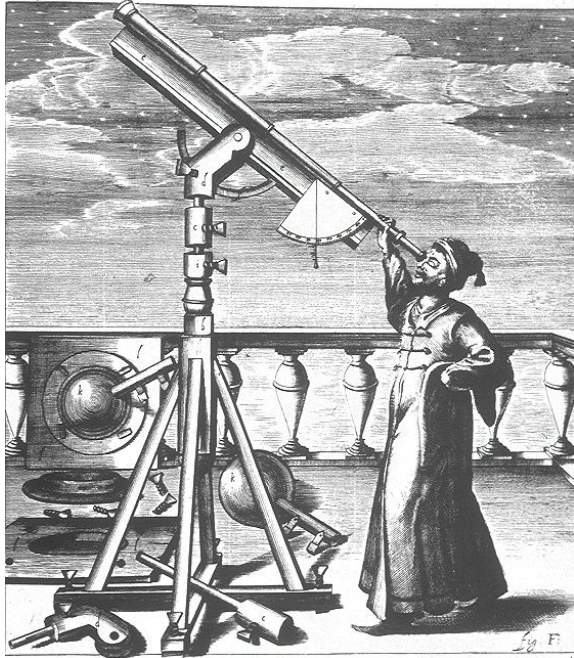
# *Imitatio = Inventio*

-Rinassance-

- **Leone Battista:** 'there is no safer way to beauty than to imitate nature'
- **Shakespeare:** ... let your tutor be your own discretion: (...) never exceeding the modesty of nature ...
- **Dürer:** nature has to be 'deciphered' and its content extracted.



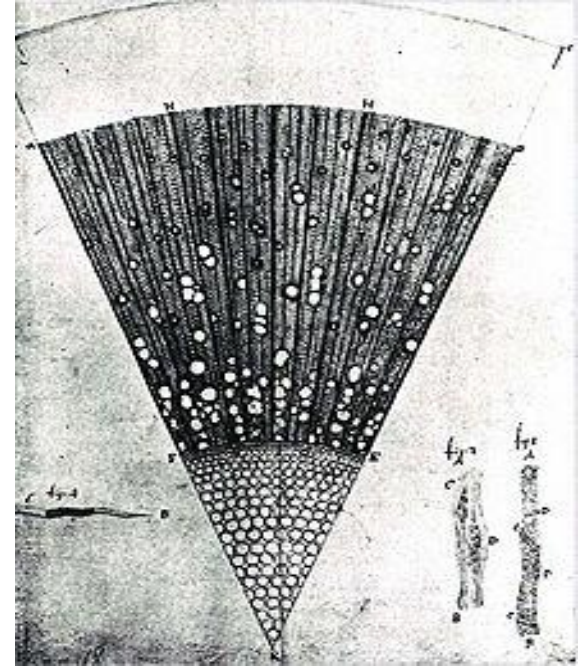
*Invenções y retratos de Da Vinci.*



Galileo using his telescopic devices.

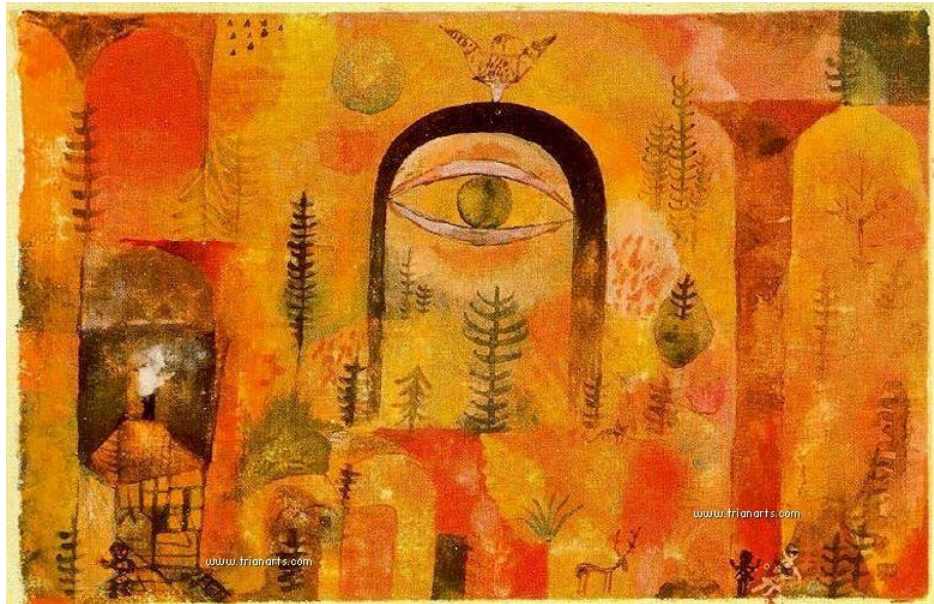
## Scientific Revolution 17th-19th Century

- Quick accumulation of knowledge
- Nature begins to be reasonably verifiable



A microscopic section of a one-year-old [ash tree](#) (*Fraxinus*) wood, drawing made by Antoine van Leeuwenhoek

# How do we understand fidelity, the truth that nature expresses?



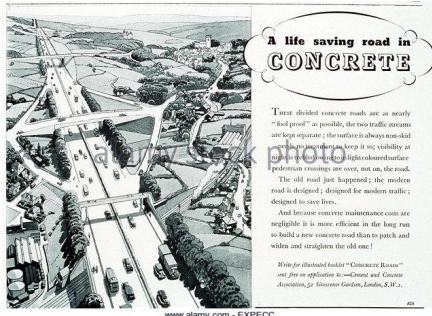
Pintura de Paul Klee

*Paul Klee* expressed 'we do not want to copy nature or imitate it, what we want is to be **able to configure something as nature shapes a fruit**'

# The new landscape 20th Century



Modern life!



## A life saving road in CONCRETE

These divided concrete roads are as nearly "fail proof" as possible, the two traffic streams are kept separate, the surface is always non-slip and the road is made deep to six inches or more. The old road just happened; the modern road is designed, designed for modern traffic; designed to save lives.

And because concrete maintenance costs are negligible it is more efficient in the long run to build a new concrete road than to patch and widen and straighten the old one!

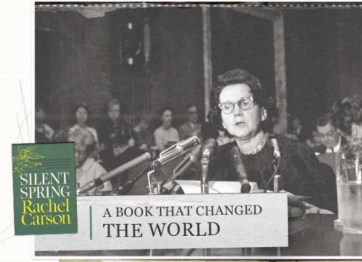
Write for illustrated booklet "Concrete Roads" and for an application to "Concrete and Concrete Association, 25 Grosvenor Gardens, London, S.W. 1."



Georgy Kepes - New Landscape exhibition MIT 1951



Rachel Carson and Buckminster Fuller in the 60s



# BioArquitectura



Caracol House, Mexico  
By Javier Senosiain  
Model: Snakes, sea shells



Munich Olympic Park,  
By Frei Otto  
Models: Tensegrity



Ciutat de les arts i les ciències  
By Santiago Calatrava  
Model: Human body/bones



Eden Project, Cornwall  
By Nicholas Grimshaw  
Model: Bubbles/Beehive



Yellow Tree House, NZ  
By Fock Associates  
Model: Chrysalis, Trees



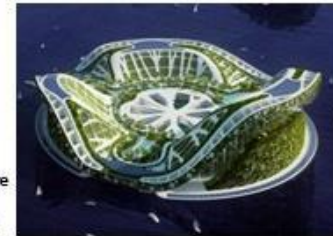
Gardens by the Bay, Singapore  
By Wilkinson Eyre  
Model: Trees, sea shells, etc.



Eastgate Building, Zimbabwe  
By Mick Pearce  
Model: Termite mounds



Research Pavilion  
By ICT/ITKE Research  
Model: Water Spider



Floating Ecopolis  
By Vincent Callebout  
Mmodel: lilypad



Evolutionary Architecture  
By Eugene Tsui  
Models: Birds, various sources



Bone Chair  
By Joris Laarman  
Model: Tree growth



Pax Volute water Pump  
By Pax Scientific  
Model: Vortes, Spirals

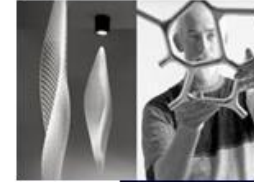
# Product Design



Franco Lodato Design  
By Franco Lodato  
Model: Various



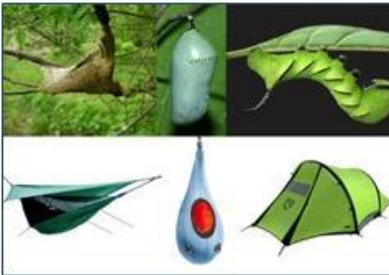
Sonar-Enabled Cane  
By UltraCane  
Model: Bat's Sonar



BioOrganic Designs  
By Ross Lovegrove  
Models: Various



BioInspired processes  
By Nery Oxman/MIT  
Model: Various



Cocoon Tents  
By Various designers  
Model: Cocoons,  
Chrysalis



Invisible street light  
By Jongoh Lee  
Model: Tree branche



Owl Fan  
By Silent Fan  
Model: Owl  
feathers



Luminaries 3Dp  
By FOC  
Models: Varios  
botanics



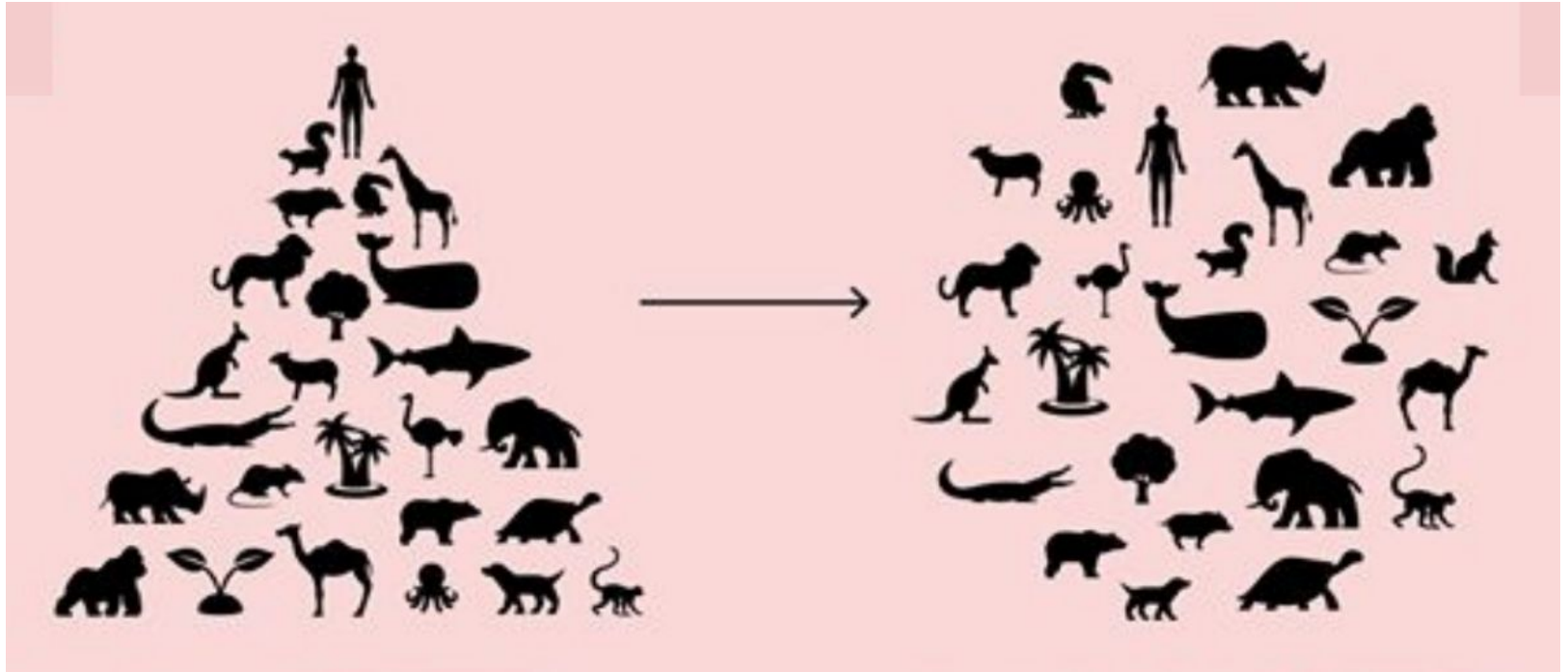
# Rediscovering Nature





# **Multispecies Design Practice**

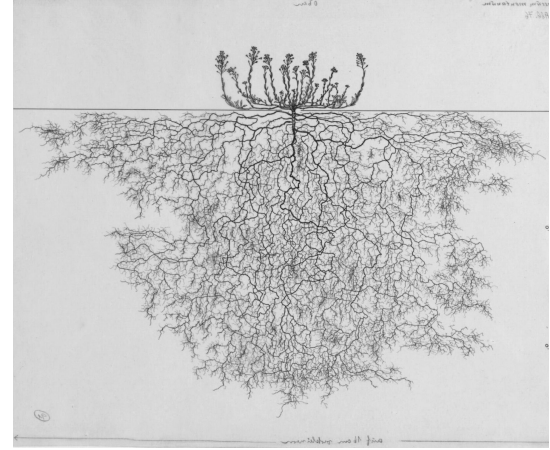
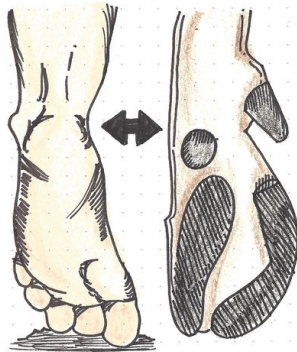
## From an Anthropogenic to Symbiogenic (posthuman) worldview



# True Empathy

“Our approach to animal studies invites us to use tools to try to get into their shells, legs, fins, and claws, because it is only then that we, as fellow human animals, can begin to understand, protect, and positively influence their world.

(Luisa Ruge)



Let's look for ways to interact with the language of nature, a language that shows us truth. Only then can we achieve a sustainable world.

(David Sánchez)



Bat and Swift housing (various authors)



Refugio (MaliArts, Mexico)

# ARA NEST



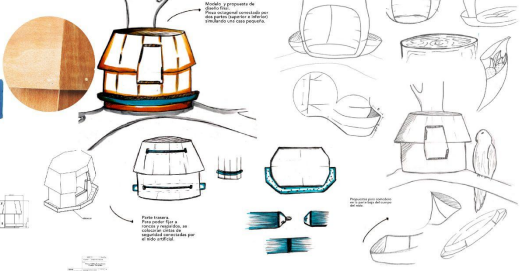
## GUACAMAYO AZUL-DORADO | ARA ARARAUNA

Ave conocida por la alta gama de colores en su cuerpo, asimismo se distingue por su tamaño ya que llega a medir más de 90 cm, es una ave vegetariana y se encuentra en un estado amenazado. Al momento de iniciar a anidar, necesita un lugar seguro en donde pueda mantener a sus crías seguras, se busca evitar el uso de cajas de cartón en Zoo's y que se asemeje a su habitat natural.

### PROPUESTA DE DISEÑO

**ARA NEST** es un nido artificial creado para el guacamayo en sus ciclos de nidificación y gestación de los pequeños, en espacios de cautiverio o en zonas donde su habitat esta siendo destruido, con el fin de que la pareja de guacamayos se sienta protegida y pueda anidar en un espacio similar a su habitat natural sin que exista en riesgo de perder a uno de los huevos.

- + Espacio amplio y adecuado para crías y padres.
- + Útil para la etapa de reproducción e incubación.
- + Comodidad y seguridad ante exterior
- + Seguridad al unir y fijar a árboles.
- + Semejante a habitat.



Medida Original  
1,55 m de alto x 95 cm  
de ancho x 45 cm de ancho x 1,2  
Profundidad. Cajas de todo con  
acero de brasa y detalle  
hueso.

# Designing for Animals

## SAKAFO

Lourdes Rubio  
AD1566428  
Proyectos III  
Prof. David Sánchez

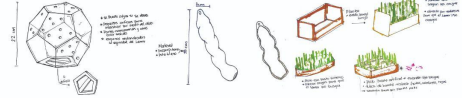
### Propuestas



### LEMUR COLA ANILLADA

Velocidad máxima - 20 km/h  
Peso - 2,5-3,5 kg  
Longitud - 95 y 110 cm

La población del lemur es de alrededor de 2.000 y 2.400 animales: ha disminuido el 95 % en las últimas dos décadas. El 50% muere en el primer año y solo el 30% llega a una vida adulta.



### PRODUCTO FINAL



Sakafo es un alimentador diseñado para el lemur de cola anillada. Contiene una caja central donde se colocan plantas y orugas, en los bambúes van alimentos como frutas, y los bambúes laterales se rellenan con nueces, los cuales tienen orificios para que en el momento de girar, salga el alimento a través de estos. Está diseñado para mejorar la vida del lemur a la hora de que se esfuerza por conseguir su alimento.

<b>Dieta:</b>	Tamarindo	Alfalfa	Grillos	fabricado con fibra de
Naranja	Lechuga	Orugas	cañabla de fibra, acabado	
Plátano	Repollo		con lisa 220 y recubierto con	
Uvas			aceite de hacha.	
Manzana			Vanilla de bambú con 4 cm	
			de diámetro	

## Designing for plants



Solaris por José Luis Gómez



Florence por Itzel Gálvez



Paradise C-T por Fabián Eduardo Iniesta

**How does a multispecies design practice fit from other current sociocultural movements?**



**Post-Humanism?**

**Post-Humanism**

**Post-Anthropocentrism**

**Post-Dualism**

**Post-Humanism**

**Post-Anthropocentrism**

Decentering the human in  
relation to the non-human

**Post-Dualism**

**Post-Humanism**

**Post-Anthropocentrism**

**Post-Dualism**

Opposing strict, rigid and absolute dualisms, particularly that can lead to hierarchical conceptions such as human vs. animal, mind vs. body

## Post-Humanism

## Post-Anthropocentrism

Human experience and activities in pluralistic rather than in generalized and universalized terms

## Post-Dualism

**Post-Humanist  
Design?**

## Aligns with

- actor-network theory
- feminist new materialism,
- object-oriented ontology
- transhumanism

## Posthumanism and Design

**Abstract** Since at least the mid-1980s, design has been dominated by a human-centered and user-centered paradigm. Currently, the implications of technological and environmental transformations are challenging designers to focus on complex socio-technical systems. This article traces emergent discussions around posthumanism from across a range of disciplines and perspectives, and considers examples from emerging design practices that emphasize the interrelations between human and nonhuman actors. Specifically, this article reviews literature from actor-network theory (ANT), feminist new materialism, object-oriented ontology, non-representational theory, and transhumanism to inform the development of new methodologies and practices in the field of design. Finally, this article presents critiques of posthumanism from critical race theory and decolonial theory to consider how emergent design perspectives might better support values such as equality and justice for humans and nonhumans that have been traditionally ignored in design processes.

### Keywords

Posthumanism  
Nonhuman  
Feminist new materialism  
Science and technology studies  
Socio-technical systems

Received December 16, 2016  
Accepted August 10, 2017

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The peer review process is the responsibility of Tongji University and Tongji University Press.

<http://www.journals.elsevier.com/she-ji-the-journal-of-design-economics-and-innovation>  
<https://doi.org/10.1016/j.sheji.2017.08.001>



Aligns with

- actor-network theory
- feminist new materialism,
- object-oriented ontology
- transhumanism

Criticism from critical race theory and decolonial theory perspectives

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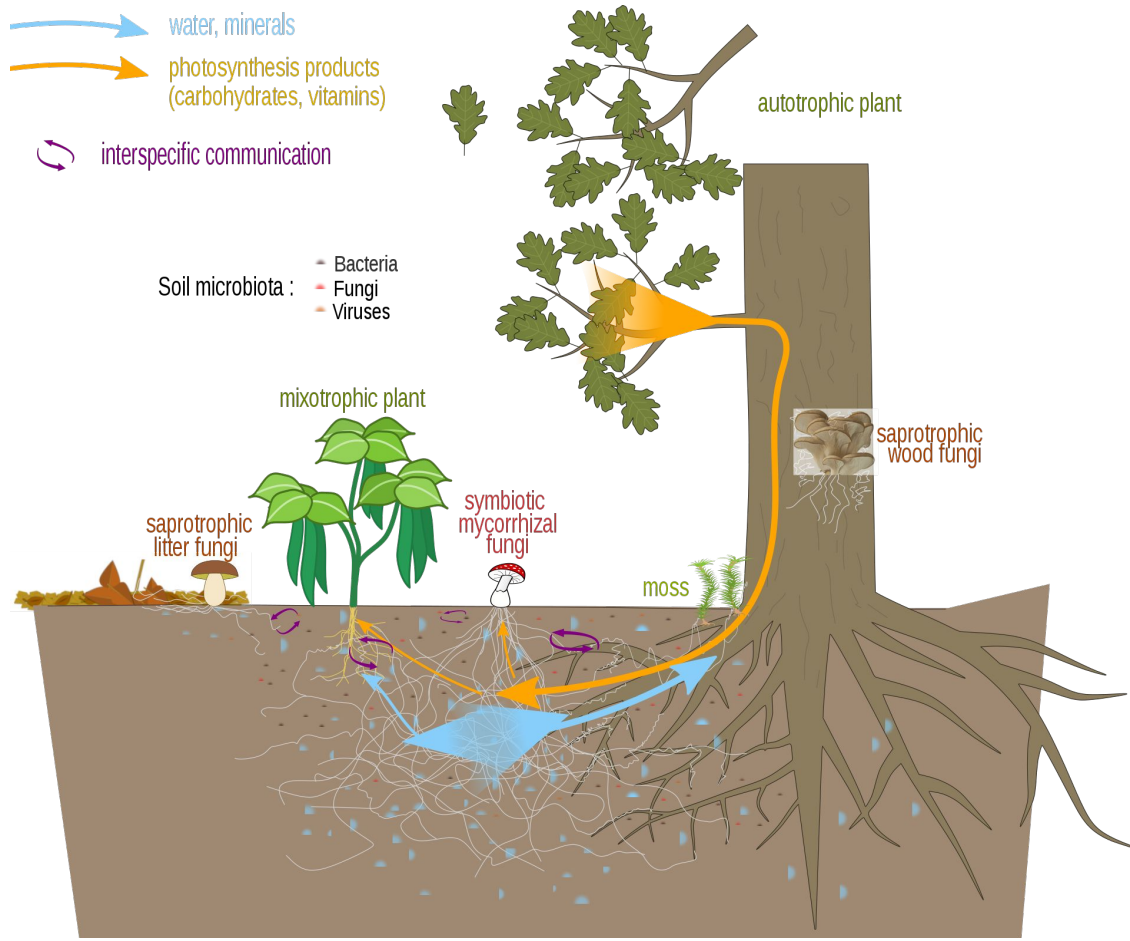
# Intelligent Artifact?





**Intelligent  
Natural  
Objects?**

# **Forest as a Cooperative**



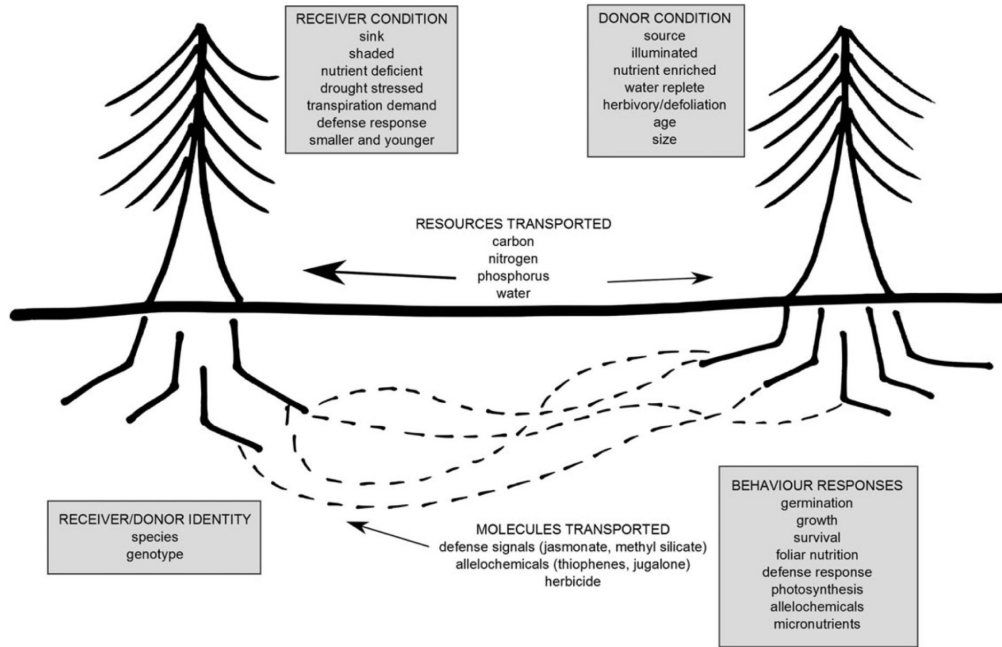
# Mycorrhizal network

## 'Wood' Wide Web

# Mycorrhiza TimeLapse



4K



**Figure 1.** Schematic of resources and signals documented to travel through an MN, as well as some of the stimuli that elicit transfer of these molecules in donor and receiver plants.

Amongst the trees of different species can:

- transmit warnings that plants are being eaten by insects or attacked by pathogens
- send food or essential nutrients to neighbors of the same or different species.

In plants of the same species:

- mycorrhizae can transmit phosphorous and nitrogen from dying plants to healthy neighbor
- transmit "piss off" signals by sending toxins to plants competing for resources nearby

## Invited Review

### SPECIAL ISSUE: Using Ideas from Behavioural Ecology to Understand Plants

## Inter-plant communication through mycorrhizal networks mediates complex adaptive behaviour in plant communities

Monika A. Gorzelak, Amanda K. Asay, Brian J. Pickles and Suzanne W. Simard\*

Department of Forest and Conservation Sciences, University of British Columbia, Vancouver, BC, Canada, V6T 1Z4

Received: 4 December 2014; Accepted: 26 March 2015; Published: 15 May 2015

Associate Editor: James F. Cahill

Citation: Gorzelak MA, Asay AK, Pickles BJ, Simard SW. 2015. Inter-plant communication through mycorrhizal networks mediates complex adaptive behaviour in plant communities. *AoB PLANTS* 7: plv050; doi:10.1093/aobpla/plv050

**Abstract.** Adaptive behaviour of plants, including rapid changes in physiology, gene regulation and defence response, can be altered when linked to neighbouring plants by a mycorrhizal network (MN). Mechanisms underlying the behavioural changes include mycorrhizal fungal colonization by the MN or interplant communication via transfer of nutrients, defence signals or allelochemicals. We focus this review on our new findings in ectomycorrhizal ecosystems, and also review recent advances in arbuscular mycorrhizal systems. We have found that the behavioural changes in ectomycorrhizal plants depend on environmental cues, the identity of the plant neighbour and the characteristics of the MN. The hierarchical integration of this phenomenon with other biological networks at broader scales in forest ecosystems, and the consequences we have observed when it is interrupted, indicate that underground ‘tree talk’ is a foundational process in the complex adaptive nature of forest ecosystems.

**Keywords:** Complex adaptive systems; ectomycorrhiza; forests; mycorrhizal networks; plant behaviour; plant communication.

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[nature](#) > [nature ecology & evolution](#) > [perspectives](#) > article

Perspective | [Published: 13 February 2023](#)

## Positive citation bias and overinterpreted results lead to misinformation on common mycorrhizal networks in forests

[Justine Karst](#) , [Melanie D. Jones](#) & [Jason D. Hoeksema](#)

[Nature Ecology & Evolution](#) 7, 501–511 (2023) | [Cite this article](#)

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PHOTO BY HUGO VAN LAWICK

[nature](#) > [articles](#) > [article](#)

[Published: 28 March 1964](#)

## **Tool-Using and Aimed Throwing in a Community of Free-Living Chimpanzees**

[JANE GOODALL](#)

[Nature](#) **201**, 1264–1266 (1964) | [Cite this article](#)

**4465** Accesses | **271** Citations | **288** Altmetric | [Metrics](#)



Goualougo Triangle Ape Project

**Human uniqueness?**

**What has been done?**



## **Habeas Corpus of Happy the Elephant**

# Personhood of Whanganui River, New Zealand







William James Harding/Alexander Turnbull Library, Wellington, New Zealand

Te Mataruru Marae -- or Māori communal place -- in Whanganui district in the 1880s. Photograph taken by the studio of William James Harding.



Alexander Turnbull Library, Wellington, New Zealand

A paddle steamer at Pipiriki on the Whanganui River, circa 1910.



# Developing New Legal Construct



Historia/Shutterstock

Photo by Historia/Shutterstock. Māori chiefs sign the Treaty of Waitangi in New Zealand on February 6, 1840.

## SHOULD TREES HAVE STANDING?— TOWARD LEGAL RIGHTS FOR NATURAL OBJECTS

CHRISTOPHER D. STONE\*

### INTRODUCTION: THE UNTHINKABLE

In *Descent of Man*, Darwin observes that the history of man's moral development has been a continual extension in the objects of his "social instincts and sympathies." Originally each man had regard only for himself and those of a very narrow circle about him; later, he came to regard more and more "not only the welfare, but the happiness of all his fellow-men"; then "his sympathies became more tender and widely diffused, extending to men of all races, to the imbecile, maimed, and other useless members of society, and finally to the lower animals. . . ."<sup>1</sup>

The history of the law suggests a parallel development. Perhaps there never was a pure Hobbesian state of nature, in which no "rights" existed except in the vacant sense of each man's "right to self-defense." But it is not unlikely that so far as the earliest "families" (including extended kinship groups and clans) were concerned, everyone outside the family was suspect, alien, rightless.<sup>2</sup> And even within the family, persons we presently regard as the natural holders of at least some rights had none. Take, for example, children. We know something of the early rights-status of children from the widespread practice of infanticide—

\* Professor of Law, University of Southern California. A.B. 1959, Harvard; LL.B. 1962, Yale. Chairman, Committee on Law and the Humanities, Association of American Law Schools. The author wishes to express his appreciation for the financial support of the National Endowment for the Humanities.

1. C. DARWIN, *DESCENT OF MAN* 119, 120-21 (2d ed. 1874). See also R. WAELDER, *PROGRESS AND REVOLUTION* 39 *et seq.* (1967).

2. See DARWIN, *supra* note 1, at 113-14.

. . . No tribe could hold together if murder, robbery, treachery, etc., were common; consequently such crimes within the limits of the same tribe "are branded with everlasting infamy"; but excite no such sentiment beyond these limits. A North-American Indian is well pleased with himself, and is honored by others, when he scalps a man of another tribe; and a Dyak cuts off the head of an offending person, and dries it as a trophy . . . It has been recorded that an Indian Thug conscientiously regretted that he had not robbed and strangled as many travelers as did his father before him. In a rude state of civilization the robbery of strangers is, indeed, generally considered as honorable.

See also Service, *Forms of Kinship in MAN IN ADAPTATION* 112 (Y. Cohen ed. 1968).

Natural entities with some of the same legal rights as humans like companies, and ships, people with disabilities, with guardians

“[I]ndivisible and living whole, comprising the Whanganui River from the mountains to the sea, incorporating all its physical and metaphysical elements.”

Version  
as at 30 November 2022



**Te Awa Tupua (Whanganui River Claims Settlement) Act  
2017**

Public Act 2017 No 7  
Date of assent 20 March 2017  
Commencement see section 2

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**Note**

The Parliamentary Counsel Office has made editorial and format changes to this version using the powers under subpart 2 of Part 3 of the Legislation Act 2019.

Note 4 at the end of this version provides a list of the amendments included in it.

**This Act is administered by the Ministry of Justice.**

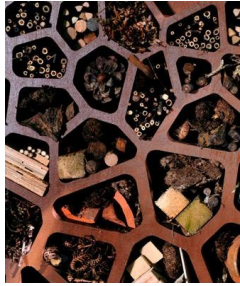
**So what?**



**Thinking like a tree/bird/forest provides us with ethical behavior and a creative lens to solve problems.**

**The ability to recognize the patterns of nature and apply them is today fundamental**

**We all have the ability to re-imagine the intentions of our living planet.**



*Biodiversity bridge Netherlands cc)*



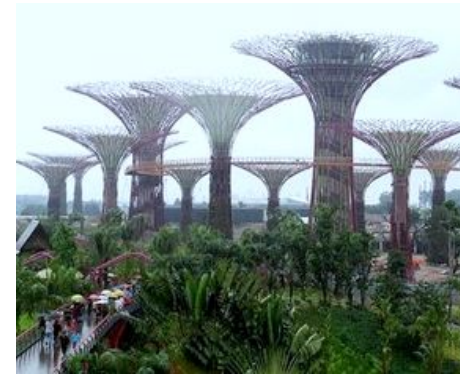
*Bee and flower in symbiosis (cc, 2012)*



*Treehouse forrest(concept)*



*Biomatrix Living machine, Manila*

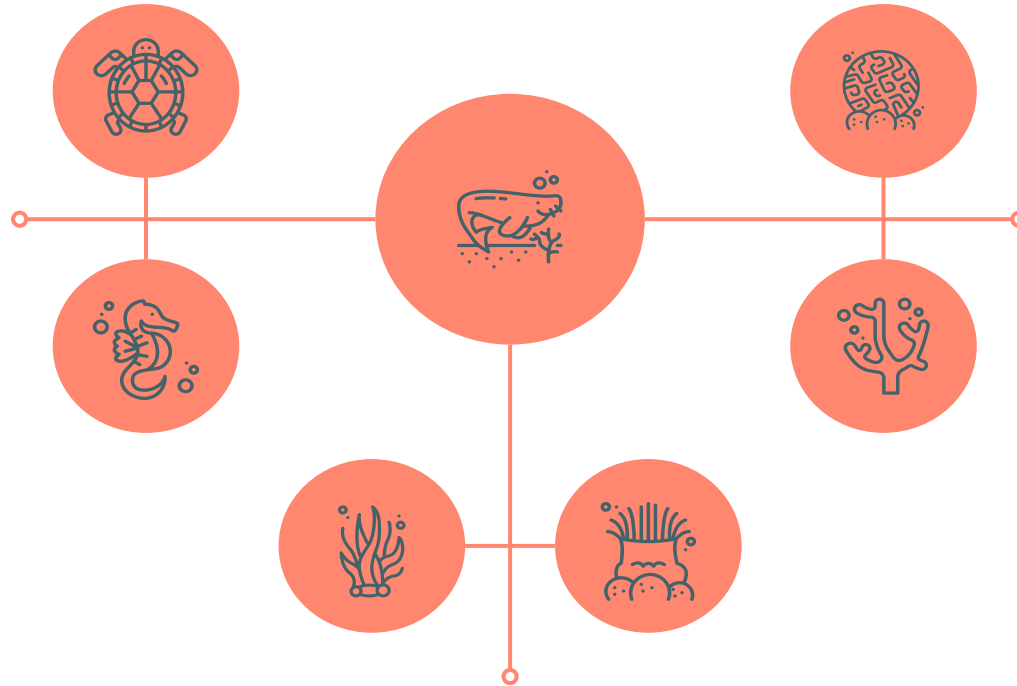


*Gardens by the bay, Singapore*

**Interaction with other species is key for co-designing a bio-civilization**

# **Activity**

# ETNOGRAPHICAL AND ETHOLOGICAL TOOLS





# Biological Empathy Mapping

¿MI NOMBRE COMUN ES? ARMADILLO

¿MI NOMBRE CIENTIFICO ES? Dasypus Novemcinctus

TAXONOMIA  
-REINO: ANIMALIA  
-FILO: Chordata vertebrata  
-CLASE: MAMMALIA

¿COMO TE COMUNICAS CON OTROS?

¿COMO VIAJAS?  
El armadillo es muy tímido y se encuentra desde el sur de E.U.A hasta la Argentina

¿COMO TE DESCRIBES?  
Es bastante pequeño pero fuerte y un poco melancólico. Prefiere de ser cazado en solitario.

¿COMO APRENDES DE OTRAS COSAS?

¿QUE OTRA INFORMACION CONOCES DE ESTE ORGANISMO?  
Apoca aproximadamente por 6 millones de años atrás.


¿QUE VALORES BIOFILICOS PUEDES IDENTIFICAR ACERCA DE ESTE ORGANISMO?  
Porque

¿DONDE VIVES?  
En cualquier lugar con clima templado o subtropical, siempre, pero si hace calor prefiero

¿QUE SENTIDOS USAS MAS?  
Quiero decir los sentidos latidos para reconocer

¿QUE COMES?  
Mezcla de frutas y algunas raíces. A veces insectos y semillas de losa.

¿COMO SOCIALIZAS?  
En solitario y con sus familiares. Me gusta estar solo pero me gusta estar con mi familia hasta el punto en donde ellos se pasan cosas.



## Mapa de empatía biológica

**MI nombre común:** ocelote

**MI nombre Científico:** Leopardus pardalis

**Nivel de vida:** Individuo

**Taxonomía:** Reino: Animalia ( animales multicelulares que se nutren por ingestión), Sub-Reino: Eumetazoa ( todos simetría), Clase: Mammalia ( poseen pelo y piel), Familia: Felidae ( gatos y felinos), Género: Leopardus ( ocelotes)

**¿Dónde Vives?**  
Su distribución actual va desde el sur de Estados Unidos hasta el norte de Argentina. En México abarca de las planicies costeras del Pacífico y del Golfo de México a la Península de Yucatán, pero está ausente en la Baja California y en el centro del país gran variedad de hábitats: bosque espeso y matorral xerófilo en el norte, y en el bosque mesófilo de montaña, selvas húmedas y secas en el resto de su distribución en el país.

**¿Cómo te comunicas con otros?**  
De hábitos solitarios y nocturnos, a través del camuflaje

**¿Cómo viajas?**  
En las noches trepando árboles

**¿Cómo te describes a ti mismo(a)?**  
Como un depredador activo, territorial con una belleza única símbolo de fortaleza y destreza, controlador del tamaño poblacional de las presas pequeñas y medianas de las que se alimenta.

**¿Qué sentido usas más?**  
el oído y el olfato.


**¿Qué comes?**  
organismos pequeños (ratones) como grandes (pezcuñiles y guanajobos, que pesan hasta 10 kg también se alimenta de otras especies como aves, lagartijas, iguanas, tlacuaches y conejos.

**¿Cómo aprendes de otros?**  
En mis primeros años con el cuidado materno por medio de la observación.

**¿Cómo socializas?**  
por competencia.

**¿Cuáles son tus valores biofilicos?**  
protección de los ecosistemas, paisajístico y culturales.

**¿Qué mas me puedes contar de ti?**  
A nivel internacional me encuentro en status de preocupación menor por la lista roja, en México mi status es en peligro de extinción según la Nom - 059. Debido a la caza furtiva por la belleza de mi piel y la degradación del hábitat



# Multispecies Design Strategy

Discuss as a team and write a short statement that includes how you will consider the impact of your works from multispecies perspectives. You can include:

- How are you going about the life principles and biophilic values and patterns?
- How will you increase your knowledge in this space?
  - Work with local biologists
- How will you build in the power mechanism for non-human species?
  - Work with wildlife preserve foundations



Shanghai 2100. (Luc Schuiten, 2009)

Thank you!